US008083497B2

(12) **United States Patent**
Gilpatrick et al.

(10) **Patent No.: US 8,083,497 B2**
(45) **Date of Patent: Dec. 27, 2011**

(54) **PRESSURE WASHER PUMP HOUSING STAND**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 261 days.

(21) Appl. No.: **12/345,914**

(22) Filed: **Dec. 30, 2008**

(65) **Prior Publication Data**

US 2009/0116972 A1 May 7, 2009

Related U.S. Application Data

(63) Continuation-in-part of application No. 29/233,732, filed on Jul. 8, 2005, now Pat. No. Des. 583,757.

(51) **Int. Cl.**
F04B 53/00 (2006.01)
F04B 17/05 (2006.01)
F16M 11/00 (2006.01)

(52) **U.S. Cl.** **417/234**; 417/360; 417/364; 248/163.1

(58) **Field of Classification Search** 417/234, 417/360, 364; 248/129, 163.1, 440, 519, 248/688; 280/47.2
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

453,856	A *	6/1891	Christy	248/129
517,211	A *	3/1894	Clarke	248/163.1
1,528,449	A *	3/1925	Meyer	417/364
2,066,030	A *	12/1936	Clark	222/179
3,115,096	A *	12/1963	Wall	417/360
3,149,651	A *	9/1964	Belrose	83/471
5,147,182	A *	9/1992	Timmons	417/234
5,494,414	A *	2/1996	Steinhart et al.	417/360
5,653,584	A *	8/1997	Mazzucato et al.	417/360
5,700,137	A *	12/1997	Simonette	417/364
7,219,873	B2 *	5/2007	Harwood	248/519
7,562,780	B2 *	7/2009	Gilpatrick et al.	211/70.6
7,604,246	B2 *	10/2009	Sodemann et al.	280/47.315

* cited by examiner

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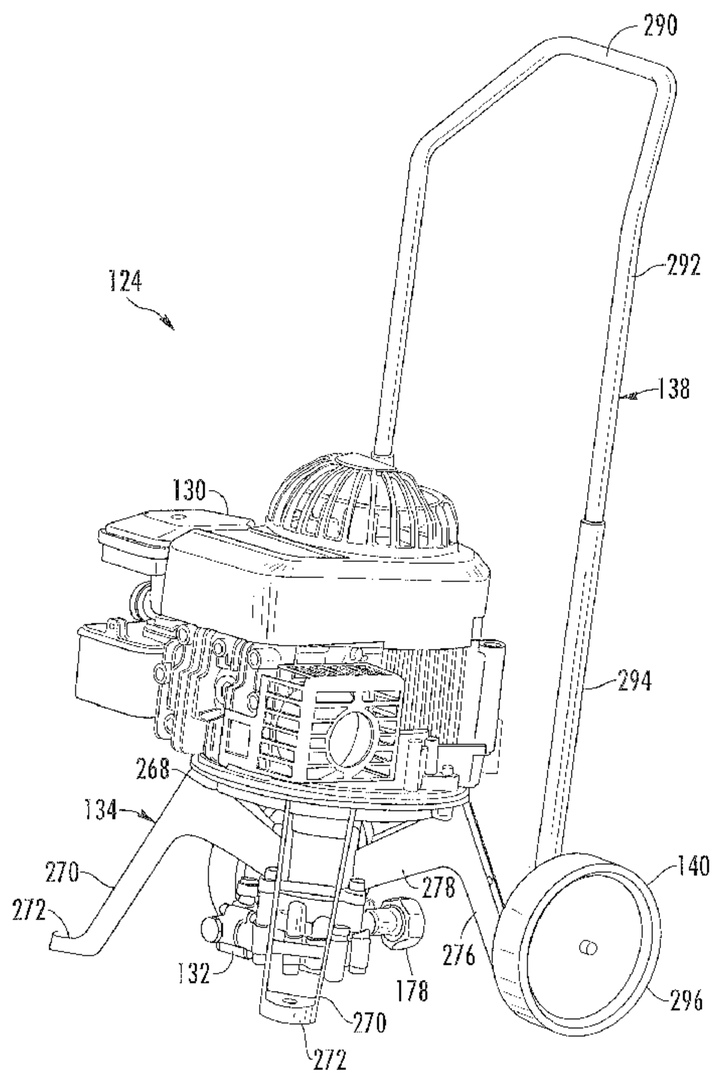
(57) **ABSTRACT**

An apparatus and method to support a pressure washer pump housing with a stand directly connected to the pressure washer pump housing. The stand comprises a horizontal platform connected to an underside of an engine and legs comprising vertical portions and strut portions, the vertical portions directly connected to and obliquely extending from the platform and the strut portions obliquely extending from the housing to the vertical portions.

22 Claims, 8 Drawing Sheets



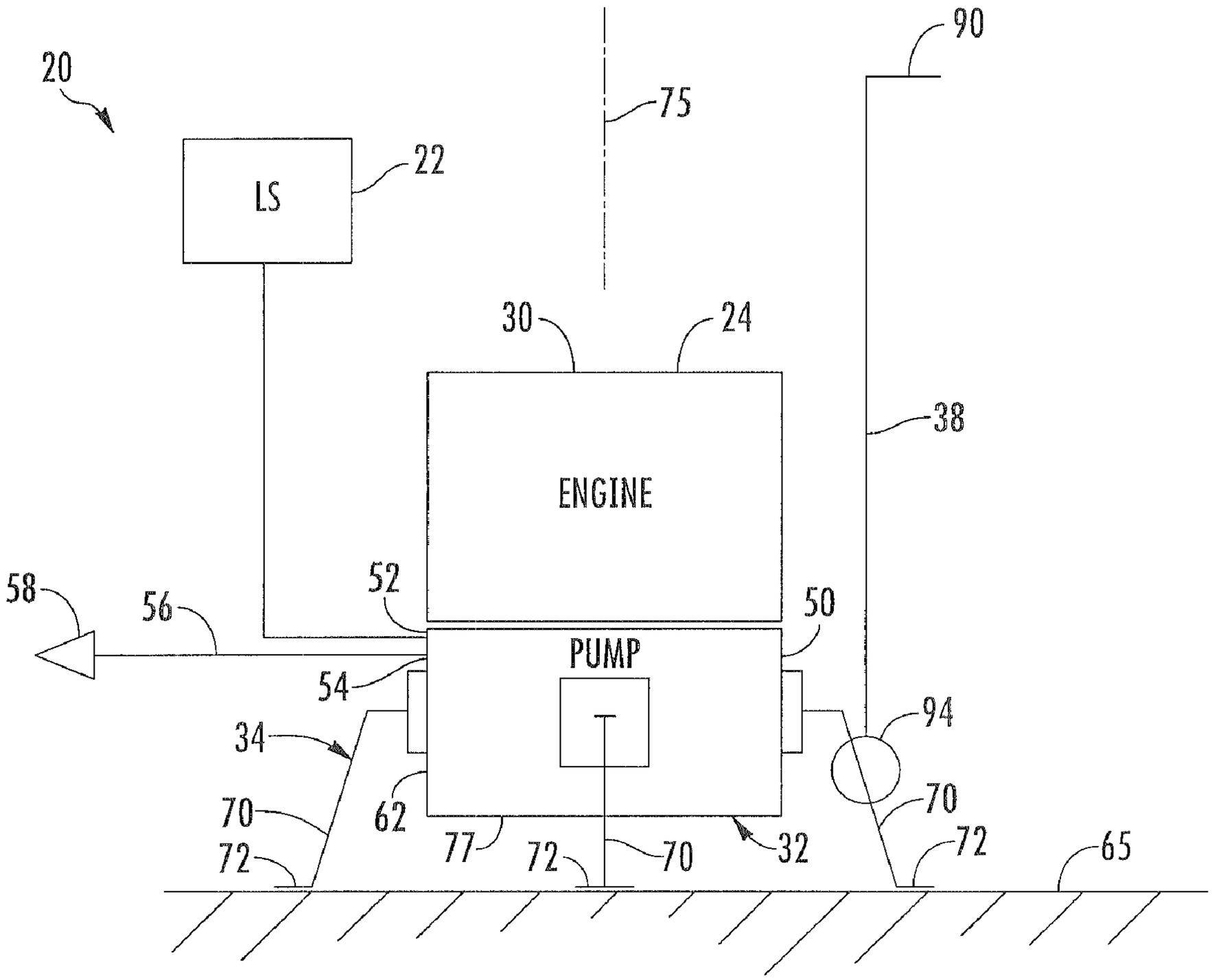

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FIG. 1

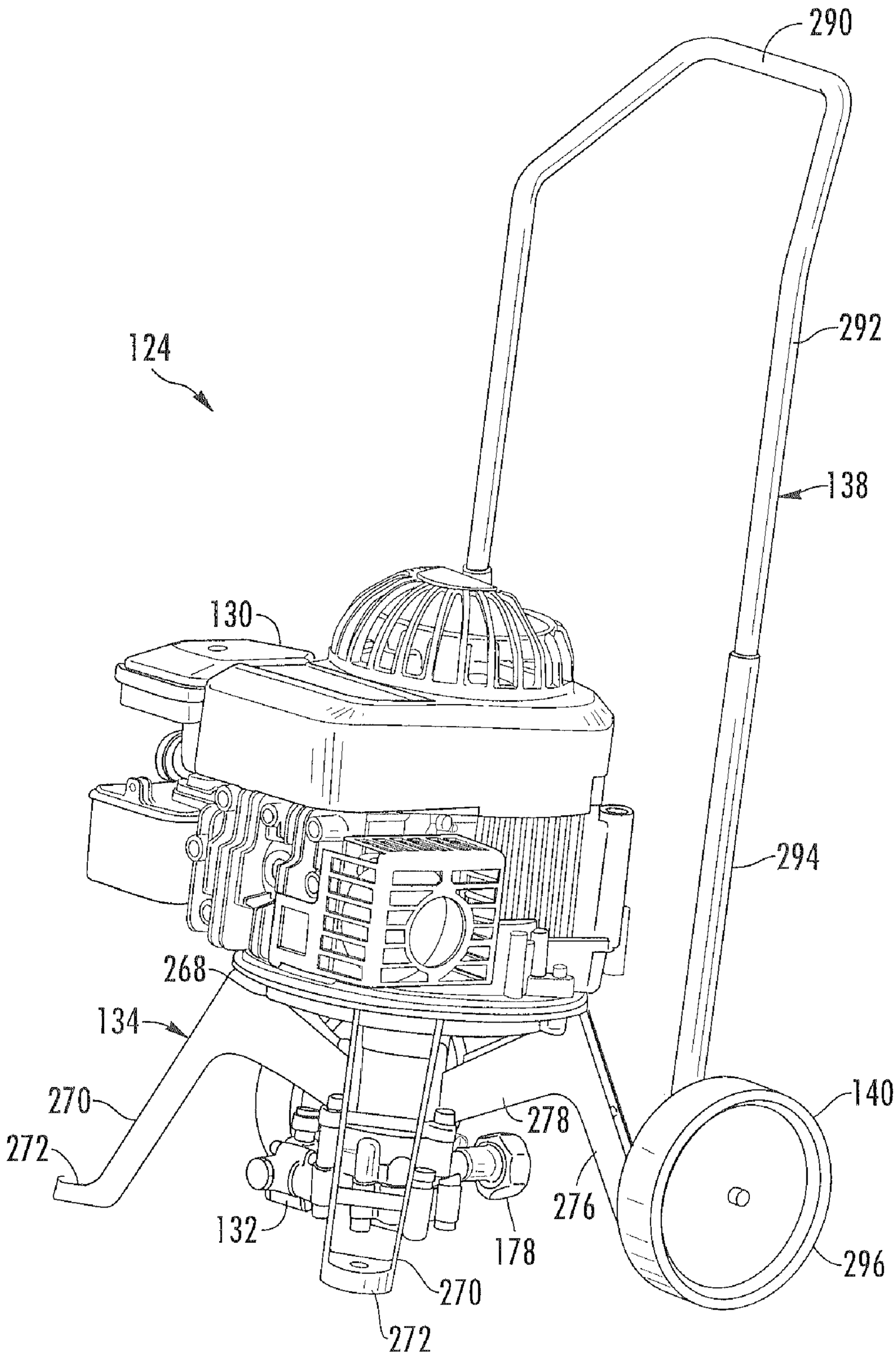
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FIG. 2

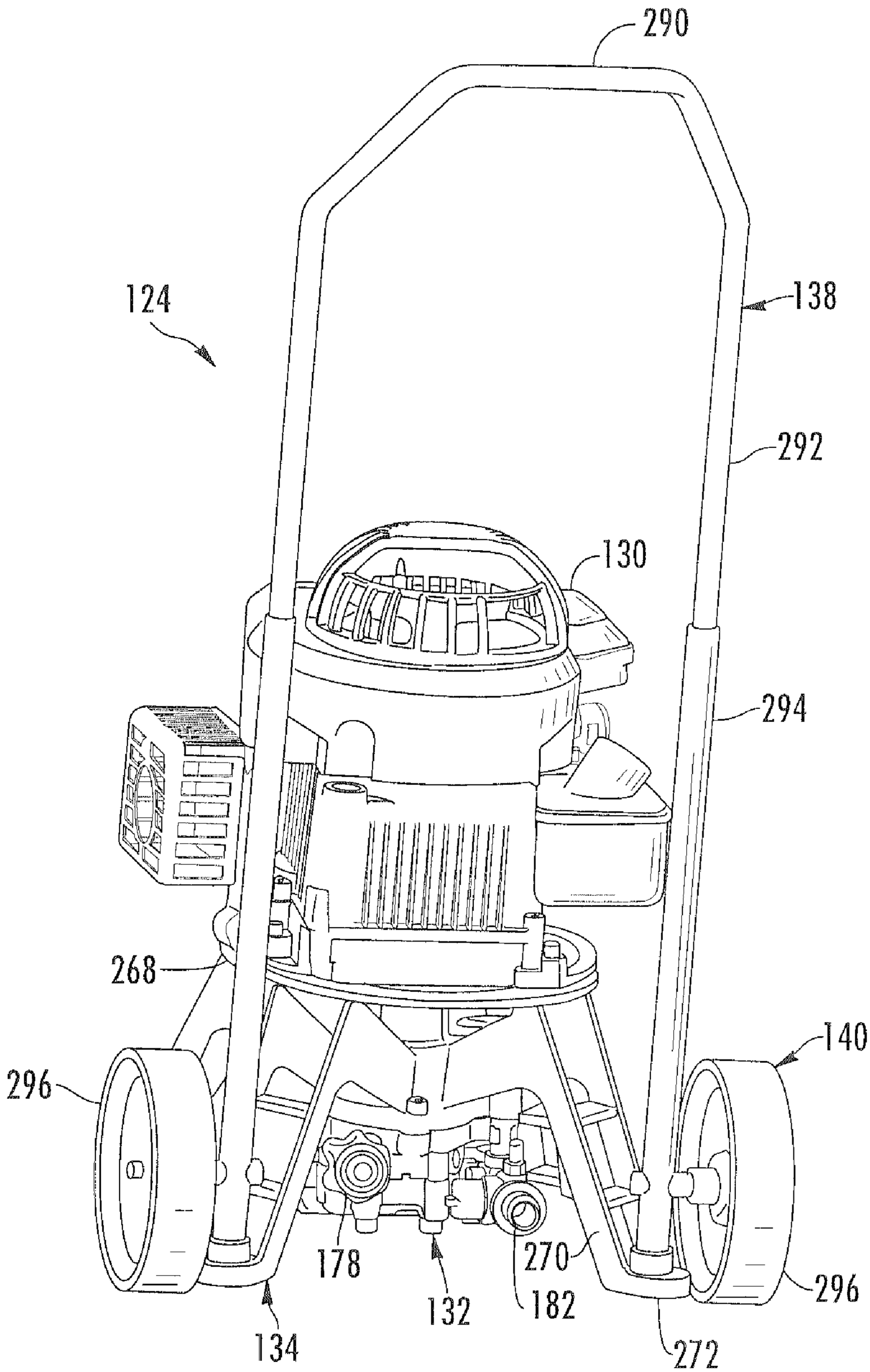

FIG. 3

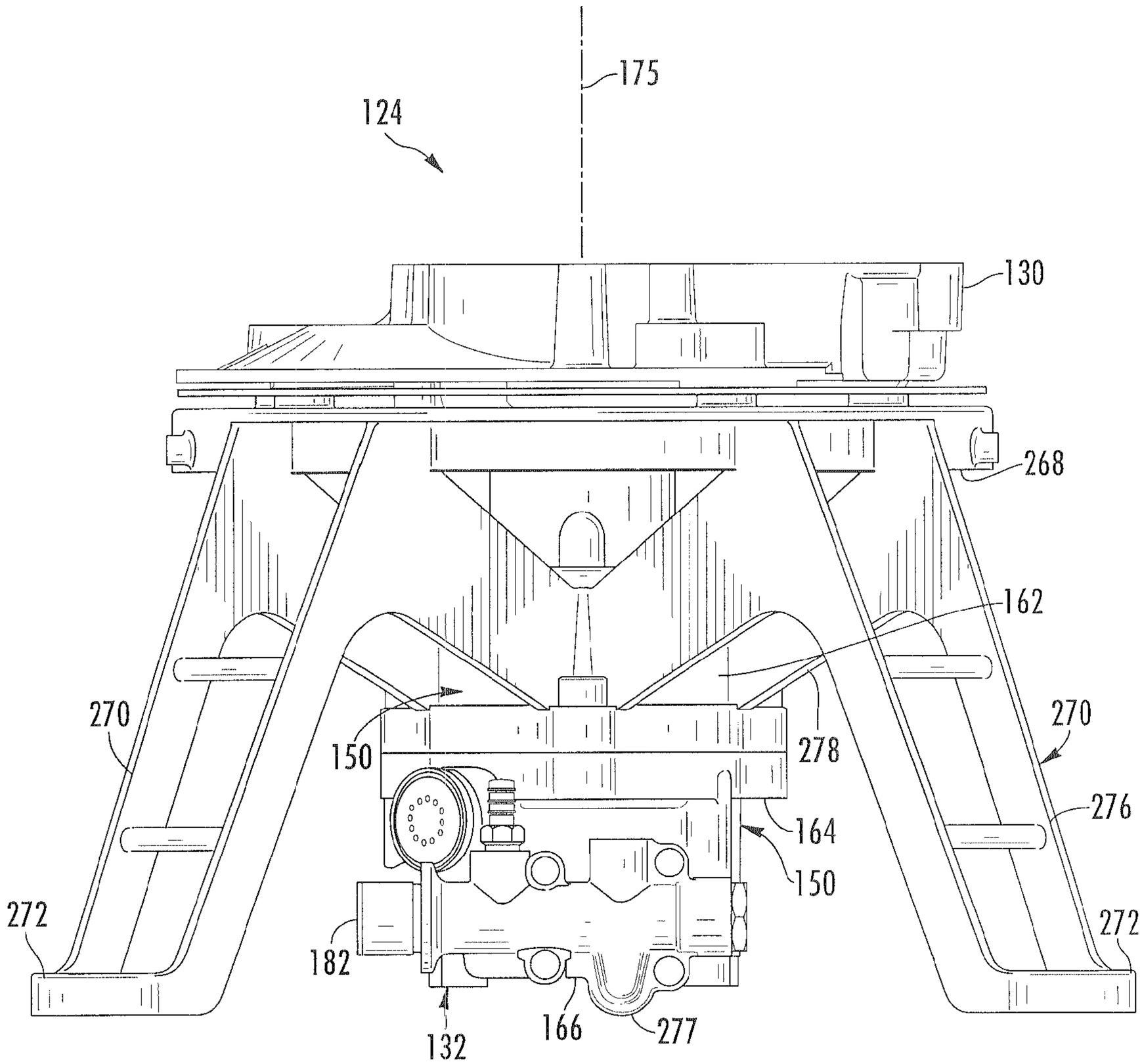
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FIG. 4

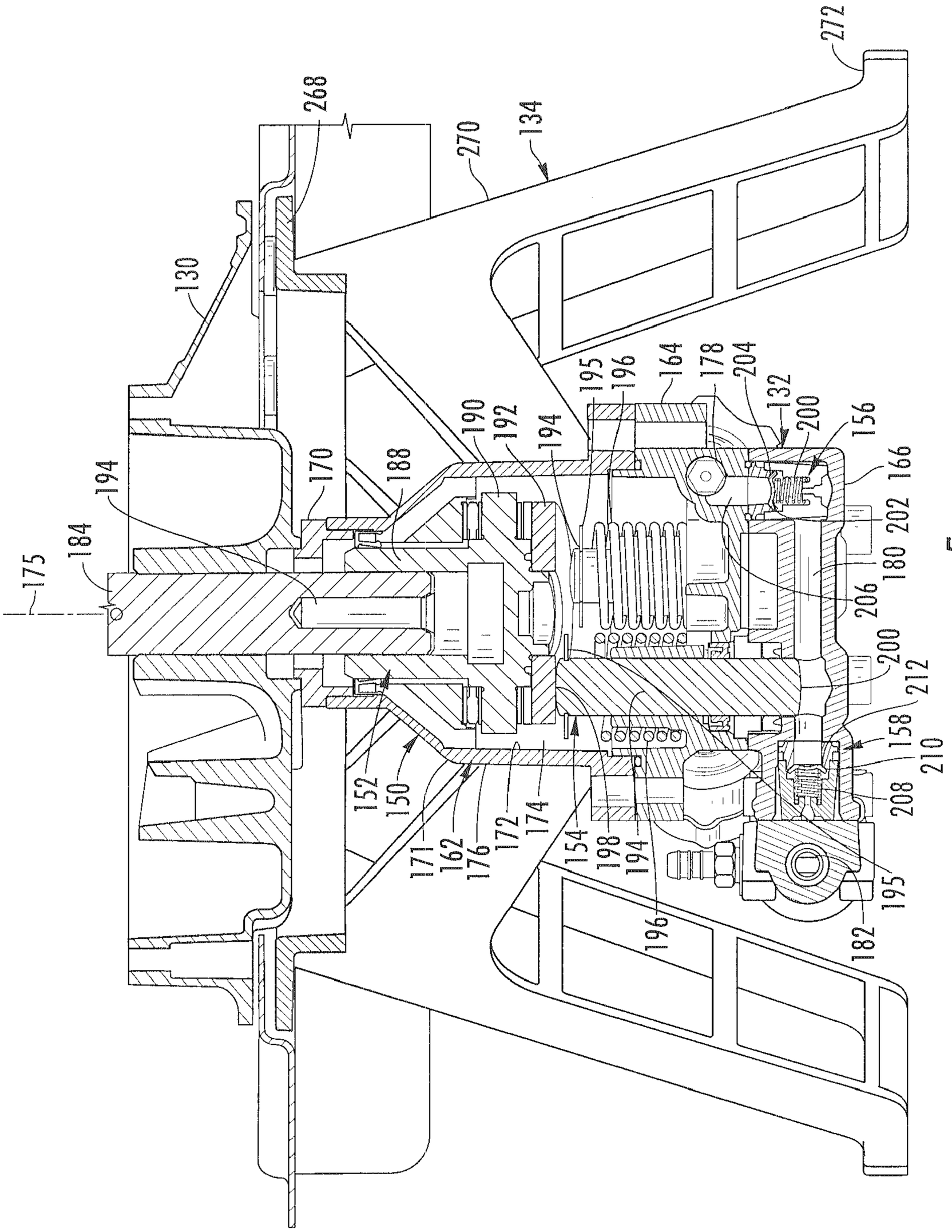
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FIG. 5

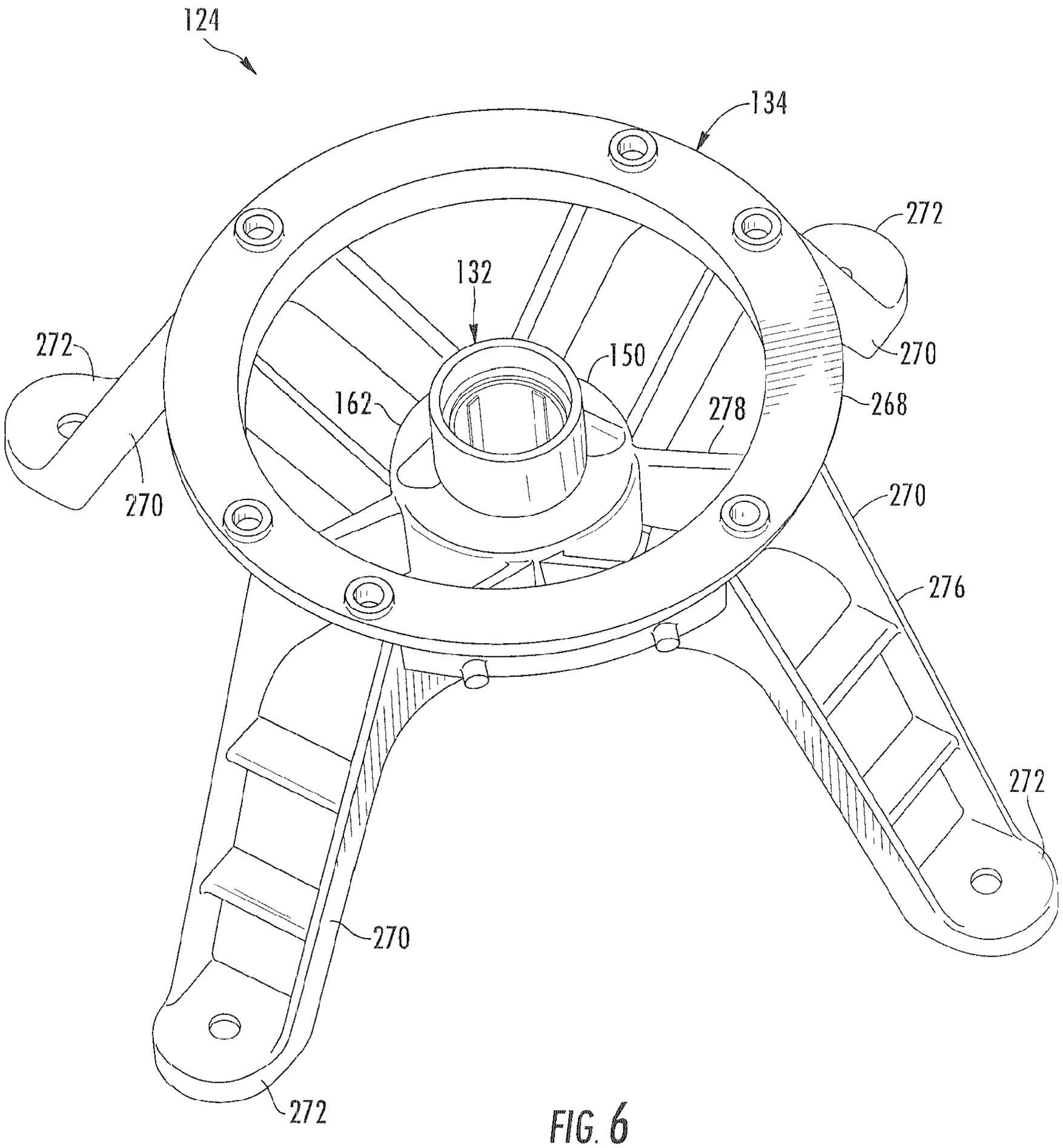

FIG. 6

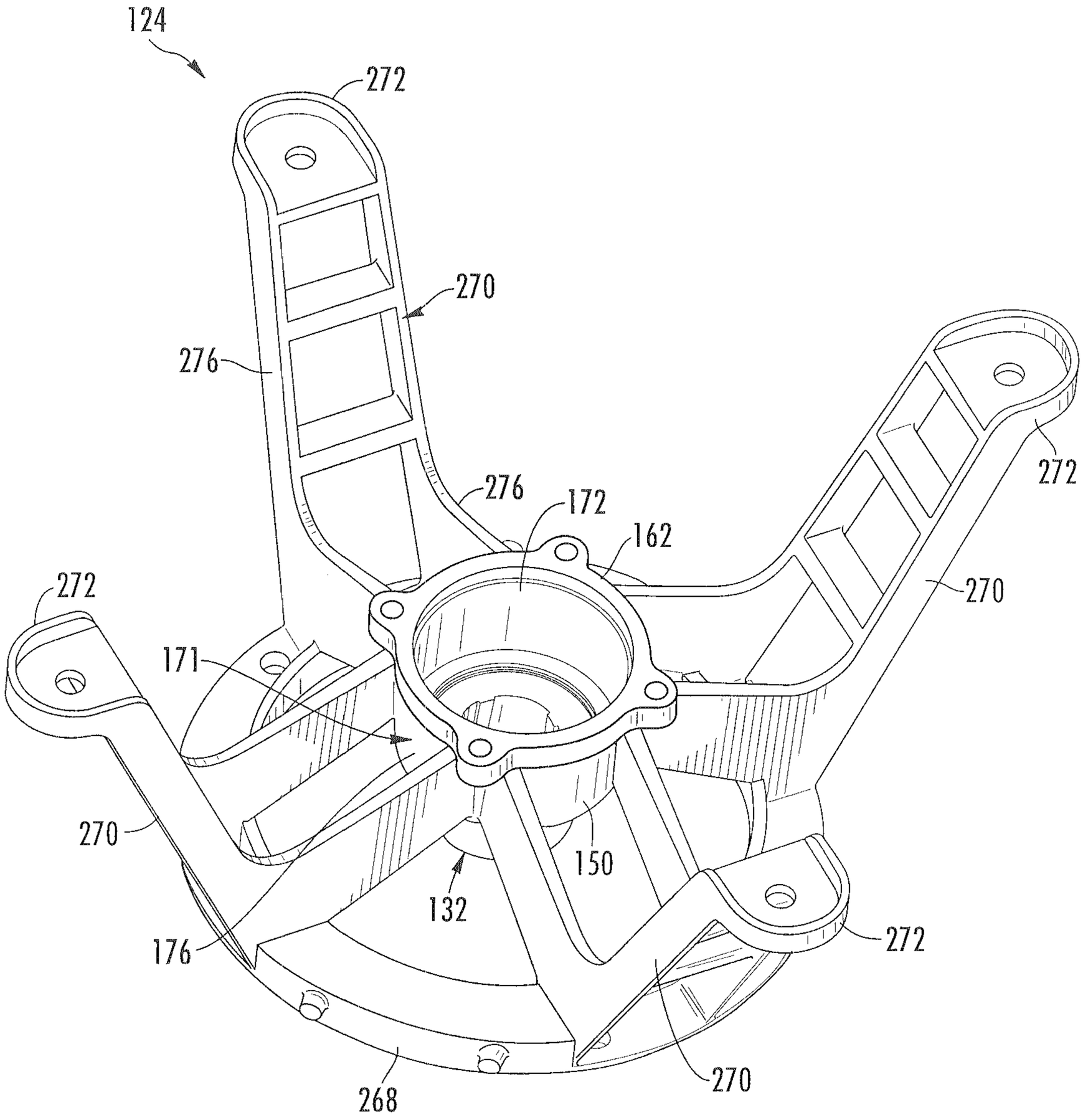
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FIG. 7

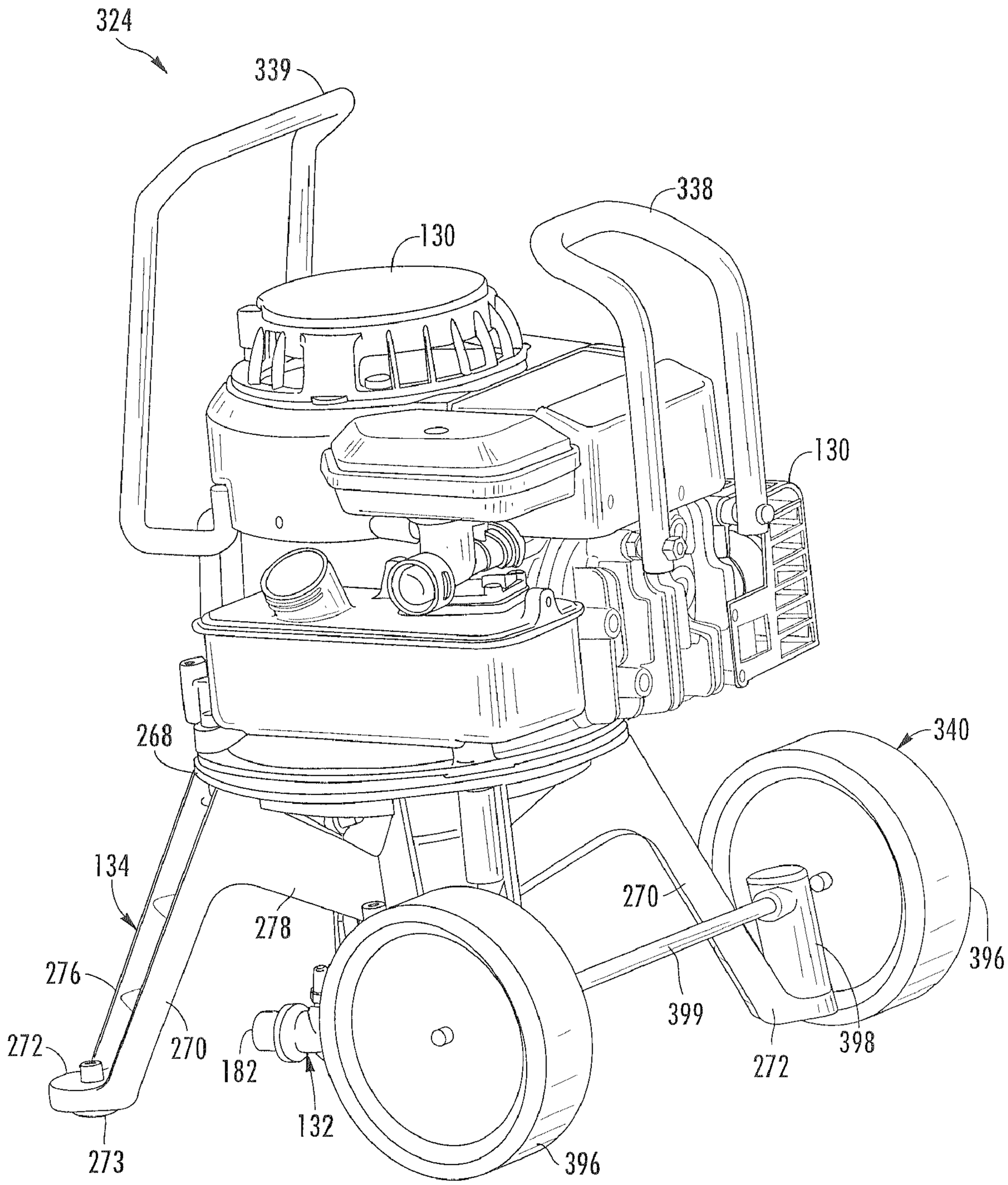
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FIG. 8

PRESSURE WASHER PUMP HOUSING STAND

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

The present application is a continuation-in-part application claiming priority from co-pending U.S. application Ser. No. 29/233,732 filed on Jul. 8, 2005 by Wesley C. Sodemann, Peter Nushart, Billy Brandenburg and Christopher Ludlum, the entire disclosure of which is hereby incorporated by reference.

BACKGROUND

Pressure washers utilize an engine to drive a pump to forcibly expel liquid under pressure. Portable pressure washers include a stand. Existing arrangements of the engine, the pump and the stand are complex, costly and space consuming.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic illustration of a pressure washer system including a pressure washer connected to a liquid source according to an example embodiment.

FIG. **2** is a front perspective view of another embodiment of the pressure washer of FIG. **1**.

FIG. **3** is a rear perspective view of the pressure washer of FIG. **2**.

FIG. **4** is a side elevation of view of a stand, a pump and a lower portion of an engine of the pressure washer of FIGS. **2** and **3**.

FIG. **5** is a sectional view of the stand, pump and lower portion of the engine of FIG. **4**.

FIG. **6** is a top perspective view of the stand and a portion of a housing of the pump of FIG. **4**.

FIG. **7** is a bottom perspective view of the stand and the portion of the housing of the pump of FIG. **4**.

FIG. **8** is a rear perspective view of another embodiment of the pressure washer of FIG. **1** according to an example embodiment.

DETAILED DESCRIPTION OF THE EXAMPLE EMBODIMENTS

FIG. **1** schematically illustrates one example of a pressure washer system **20**. Pressure washer system **20** generally includes liquid source **22** and pressure washer **24**. Liquid source **22** comprises a source of relatively low pressure liquid, such as water, connected to pressure washer **24**.

Pressure washer **24** pumps the low pressure liquid such after liquid may be ejected at a relatively higher pressure. Pressure washer **24** includes engine **30**, pressure washer pump **32**, stand **34** and handle **38**. As will be described hereafter, stand **34** is directly connected to pump **32**, reducing the complexity, cost and space consumption of pressure washer **24**.

Engine **30** comprises a small internal combustion engine such as those commercially available from Briggs & Stratton of Wauwatosa, Wis., such as single cylinder vertical shaft engines: M9, M10, M12 and W14; V-twin vertical shaft engines, M40, M44, M49. In other embodiments, engine **30** may alternatively comprise smaller or larger engines sold or manufactured by Briggs & Stratton or others. Engine **30** is supported above pump **32**. Engine **30** supplies motion or power so as to drive pump **32**.

Pump **32** receives low pressure liquid from liquid source **22** and outputs the same liquid at a much greater pressure. According to one embodiment, pump **32** comprises a pump at least similar to the pump shown and described in U.S. Pat. No. 6,092,998 to Dexter et al. which issued on Jul. 25, 2000, the full disclosure of which is hereby incorporated by reference. In other embodiments, pump **32** may comprise other pumps having other configurations.

In the example illustrated, pump **32** comprises an outer housing **50**, an inlet **52**, an outlet **54** and a hose or other fluid connection **56** terminating at a spray wand **58**. Outer housing **50** encloses internal components of pump **32**. In one embodiment, housing **50** has an outer wall with an interior surface forming an internal volume or chamber containing lubricant and moving components, such as a wobble plate (not shown) or other powered reciprocating or rotating components of the pump. As will be described hereafter, the outer wall has an exterior surface or outer surface **62** to which stand **34** is directly connected.

Inlet **52** provides an opening by which low pressure liquid from liquid source **22** enters pump **32**. Outlet **54** comprises an opening by which liquid pressurized by pump **32** enters fluid connection **56**. Spray wand **58** comprises a manual device by which a person may direct the pressurized liquid and control its discharge.

Stand **34** supports engine **30** and pump **32**. In one embodiment, stand **34** elevates engine **30** and pump **32** above a support surface **65**, such as a floor or ground. Stand **34** includes legs **70** and feet **72**. Legs **70** extend from housing **50** of pump **32** and terminate at feet **72**. Legs **70** are directly connected to housing **50** of pump **32**. Because housing **50** of pump **32** is connected directly to stand **34**, pump **32** is better stabilized against vibration. Because housing **50** of pump **32** is connected directly to stand **34**, housing **50** of pump **32** supplements the rigidity of stand **34**. As a result, the combination of housing **50** and stand **34** forms a more rigid and sturdy structure for supporting pump **32** and engine **30**. In addition, because housing **50** of pump **32** forms a part of the overall structure supporting pressure washer **24**, pressure washer **24** may be formed with fewer parts, is less complex and is more compact.

In the particular example illustrated, legs **70** are directly connected to housing **50** of pump **32** at multiple spaced locations about pump **32**. In one embodiment, legs **70** are equiangularly spaced about pump **32**. In one embodiment, housing **50** of pump **32** extends along and is centered about a vertical axis **75**, wherein legs **70** include at least three legs, and nominally four legs, angularly spaced from one another about axis **75**. In one embodiment, legs **70** concentrically extend about pump housing **50**. Housing **50** has a lower end **77** between locations where each of legs **70** is connected to housing **50** and feet **72**. As a result, pump **32** and its housing **50** are at least partially nested within and between legs **70**. Consequently, the height of pressure washer **24** is reduced, providing pressure washer **24** with a lower center of mass. The length of legs **70** may also be reduced. Thus, pressure washer **24** is more compact and more stable.

According to one embodiment, stand **34** and its legs **70** are directly joined to outer wall **62** of pump housing **50** by being integrally formed as part of a single unitary body with wall **62** of housing **50**. As a result, the overall supporting structure provided by pump housing **50** and stand **34** is stronger and more rigid. In one embodiment, pump housing **50** and legs **70** are integrally formed as a single unitary body from a cast, or molded metal, such as aluminum. In other embodiments, housing **50** and stand **34** maybe form from other materials. In

another embodiment, legs **70** are integrally formed as part of a single unitary body with wall **62** of housing **50** by being welded to wall **62**.

According to another embodiment, stand **34** and its legs **70** are directly joined to outer wall **62** of pump housing **50** by being mounted directly to housing **50** or wall **62** of housing **50**. For example, one embodiment, legs **70** may be riveted or otherwise fastened to housing **50** in a substantially permanent manner, wherein removal or separation of stand **34** from pump housing **50** would require breaking, cutting or severing of those elements securing stand **34** to pump housing **50**.

In one embodiment, legs **70** are directly connected to housing **50** of pump **32** in a removable fashion. For example, in one embodiment, legs **70** are directly connected to pump housing **50** with screws, bolts or other fasteners which require the use of tools, but which allow legs **70** to be separated from pump housing **50** without permanent deformation or destruction of the fastening elements. In still other embodiments, legs **70** are directly connected to pump housing **50** with one or more releasable or removable fastening structures that allow legs **70** to be manually separated from pump housing **50** without the use of tools. For example, in one embodiment, each of legs **70** or multiples of legs **70** interconnected as a group or subgroup of the total number of legs **70** may be secured to pump housing **50** using tongue and groove arrangements, snap lock arrangements and the like. In one embodiment, housing **50** may be provided with the groove that is configured receive a tongue associated with one or more of legs **70**. In other embodiments, this relationship may be reversed. In those embodiments in which legs **70** are removable or separable from housing **50** without deforming or destroying parts of the connection, legs **70** may be removed for storage or shipment. Legs **70** may also be removed for replacement or repair.

Feet **72** extend from a lower end of each of legs **70** and are configured to bear against or rest upon the supporting surface such as supporting surface **65**. Feet **72** provide a stable structure for supporting pressure washer **24**. According to one embodiment, feet **72** may be provided with shoes (not shown) which provide increased gripping or friction. In other embodiments, feet **72**, themselves, may have surfaces configure to grip surface **65**. In some embodiments, feet **72** may provide structures upon which wheel assemblies may be mounted. In yet other embodiments, feet **72** may be omitted.

Handle **38** comprises a structure coupled to the remainder of pressure washer **24** configured to facilitate repositioning and transport of pressure washer **24**. Handle **38** includes a manual gripping portion **90** by which a person may manually grasp handle **38**. Gripping portion **90** extends above engine **30**. As a result, a person may individually move pressure washer **24** by grasping gripping portion **90** without having to bend over as much. In particular embodiments, handle **38** is configured to be actuated between different configurations or lengths such that gripping portion **90** may be set at different heights with respect to engine **24**. As a result, gripping portion **90** may be set at different heights to accommodate different heights of different individuals or gripping portion **90** may be repositioned below a top of engine **30** to facilitate compact storage or shipment. In one embodiment, handle **38** is telescopic, wherein an upper portion of handle **38** telescopically extands and retracts with respect to a lower portion of handle **38**. In another embodiment, handle **38** may include multiple segments configure to be pivoted or folded relative to one another. In yet other embodiments, handle **38** may have a single non-adjustable height or length.

In one embodiment, handle **38** is connected to pump **24** by being connected to legs **70** at junction **94**. In one embodiment, junction **94** is a fixed or permanent junction such that handle **38** may not be separated from one or more of legs **70**. In another embodiment, junction **94** is configured facilitate separation of handle **38** from legs **70** without permanent deformation or permanent physical damage of junction **94** such that handle **38** may be subsequently reattached to the one or more legs **70**. In one embodiment, junction **94** may comprise a joint allowing the angle at which handle **38** extends from legs **70** and from the remainder of pressure washer **24** to be adjusted. Although junction **94** is illustrated as being provided on legs **70**, in other embodiments, junction **94** may be provided on one or more of feet **72**. It still other embodiments, junction **94** may be directly connected to other portions of stand **34**, to engine **30** or to pump **32**. In some embodiments, handle **38** may be omitted.

FIGS. **2** and **3** illustrates pressure washer **124**, a particular embodiment of pressure washer **24** shown in FIG. **1**. Like pressure washer **24**, pressure washer **124** is configured to be used with a liquid source **22** to pressurize the liquid from source **22**, wherein the pressurized liquid is expelled using a manual discharge device, such as wand **58** (shown in FIG. **1**). Like pressure washer **24**, pressure washer **124** is portable (it has a weight and size such that it may be manually moved by one or more individuals) and offers an arrangement of an engine, pump and stand that is compact, sturdy and less complex.

As shown by FIGS. **2** and **3**, pressure washer **124** generally includes engine **130**, pressure washer pump **132**, stand **134**, handle **138** and wheel assembly **140**. As will be described hereafter, stand **134** is directly connected to pump **132**, reducing the complexity, cost and space consumption of pressure washer **124**.

Engine **130** comprises a small internal combustion engine such as those commercially available from Briggs & Stratton of Wauwatosa, Wis., such as single cylinder vertical shaft engines: M9, M10, M12 or W14; V-twin vertical shaft engines, M40, M44, M49. In other embodiments, engine **130** may alternatively comprise smaller or larger engines sold or manufactured by Briggs & Stratton or others. Engine **130** is supported above pump **132**. Engine **130** supplies motion or power so as to drive pump **132**.

Pump **132** receives low pressure liquid from liquid source **22** (shown in FIG. **1**) and outputs the same liquid at a much greater pressure. According to one embodiment, pump **132** comprises a pump at least similar to the pump shown and described in U.S. Pat. No. 6,092,998 to Dexter et al. which issued on Jul. 25, 2000, the full disclosure of which is hereby incorporated by reference. In other embodiments, pump **132** may comprise other pumps having other configurations.

As shown by FIGS. **4** and **5**, in the example illustrated, pump **132** comprises an outer housing **150**, rotary shaft assembly **152**, piston assembly **154**, low pressure inlet valve assembly **156** and high pressure outlet valve assembly **158**. Outer housing **150** encloses internal components of pump **132**. In the example illustrated, housing **150** includes cam enclosure **162**, journal plate **164** and head **166**. Cam enclosure **162** substantially encloses rotary shaft assembly **152**. Enclosure **162** has an upper end sealed by an oil shaft seal **170** and a lower and joined to journal plate **164**. Cam enclosure **162** has a wall **171** with an inner surface **172** at least partially forming or defining an internal chamber **174** and outer surface **176**. Internal chamber **174** receives a lower portion of rotary shaft assembly **152** and a portion of piston assembly **154**. Internal chamber **174** further forms a sump or reservoir configured to contain a bath of lubricant about portions of rotary shaft assembly **152** and piston assembly **154**. Outer surface

176 extends substantially opposite to inner surface 172 and is directly connected to, contacted by or directly joined to stand 134.

Journal plate 164 extends between cam enclosure 162 and head 166. Journal plate 164 cooperates with cam enclosure 162 to form chamber 174. Journal plate 164 additionally supports or journals moving components of piston assembly 154. Although stand 134 is illustrated as being directly connected to cam enclosure 162 of outer housing 150, in other embodiments, stand 134 may alternatively be directly connected to exterior portions of journal plate 164. In the example illustrated, journal plate 164 defines a low pressure liquid inlet 178 through which liquid from liquid source 22 (shown in FIG. 1) enters pump 132. In other embodiments, inlet 178 may be provided in other portions of housing 150.

Head 166 extends at a lower end of outer housing 150. Head 166 is joined to a lower end of journal plate 164. Head 166 forms a fluid passage 180 between low pressure fluid inlet 178 and a high-pressure fluid outlet 182. Fluid passage 180 receives at least portions of the pressure valves on 156 and high-pressure valve assembly 158. Passage 180 is additionally in communication with portions of piston assembly 154, whereby liquid within passage 180 is pressurized prior to being ejected through opening 182.

Rotary shaft assembly 152 is configured to interface with a drive shaft 184 of engine 130. Rotary shaft assembly 152 is further configured to transmit force or motion from driveshaft 184 to piston assembly 154 to pressurize liquid within passage 180. Rotary shaft assembly 152 includes cam shaft 188, wobble plate 190 and thrust washer 192. Camshaft 188 comprises a member configured to connect to driveshaft 184 of engine 130. In the particular embodiment illustrated, camshaft 188 includes a key or slot 194 which mates with a corresponding slot or key of shaft 184. In other embodiments, camshaft 188 may be configured to be connected to driveshaft 184 in other fashions.

Wobble plate 190, also known as an annular cam, extends from or is joined to camshaft 188 and is received within chamber 174. Wobble plate 190 supports the thrust washer 192. As will be described here after, wobble plate 190 and thrust washer 192 interface with piston assembly 154 to reciprocate pistons 194 of piston assembly 154 upon rotation of driveshaft 184 and camshaft 188. Thrust washer 192 mounts to wobble plate 190 and bears against pistons 194 of piston assembly 154. Thrust washer 192 provides a bearing surface for rotary shaft assembly 152.

In the example illustrated, thrust washer 192 has an uneven or non-level surface such that a plurality of pistons 194 of piston assembly 154 are sequentially driven. In other embodiments, the uneven surface may alternatively be provided by wobble plate 190. In yet other embodiments, thrust washer 192 and wobble plate 198 may be provided by a single structure. Although wobble plate 190 is illustrated as being integrally formed a single unitary body with camshaft 188, in other embodiments camshaft 188 may be a separate element joined to wobble plate 190 such as being threaded to wobble plate 190. In still other embodiments, rotary driveshaft assembly 152 may have other configurations.

Piston assembly 154 receives force from rotary driveshaft to pressurize liquid within passage or channel 180. Piston assembly 154 includes pistons 194 (two of which are shown), piston caps 195 and piston springs 196. In one embodiment, piston assembly 154 includes three sets of pistons 194, caps 195 and piston springs 196. Pistons 194 have an upper end 198 in contact with thrust washer 192. Each upper end 198 supports and is fixed to or integrally formed with a piston cap 195. Each upper end 198 is contained within chamber 174. Each piston 194 has a lower end 200 in communication with passage 180.

Piston springs 196 comprised compression springs captured between journal plate 164 and piston caps 195. Piston springs 196 react against piston caps 195 to urge pistons 194 in an upward direction into abutment with thrust washer 192. As wobble plate 190 and thrust washer 192 are rotated by the rotation of driveshaft 184, each of pistons 194 reciprocate upwardly and downwardly within housing 150 and through journal plate 164. As a result, liquid within passage 180 is pressurized.

Low-pressure valve assembly 156 is contained within passage 180 between low-pressure inlet 178 and high-pressure fluid outlet 182. Low pressure valve assembly 156 provides one-way fluid communication from inlet 178 to fluid passage 180. As a result, low pressure water or other liquid can only flow into passage 180.

In the example illustrated, assembly 156 includes a valve spring 200 that biases a valve poppet 202 against a valve seat 204. During an intake stroke of each piston 194, (upward movement of piston 194 in FIG. 5), the pressure of the liquid contained within the interior cavity 206 in journal plate 164 is greater than the pressure water contained in channel or passage 180. As a result, valve poppet 202 is moved off of valve seat 204 to allow inlet water or liquid to pass through inlet valve assembly 156 into the passage 180. During the power stroke of piston 194 (downward movement of piston 194), wherein valve assembly 86 acts as a check valve and prevents the high-pressure water in the fluid channel 180 from flowing through the inlet valve assembly 156 and into chamber 206.

High-pressure outlet assembly 158 is disposed in the passage 180 proximate to fluid outlet 182. In the example illustrated, high-pressure outlet valve assembly 158 includes a valve spring 208 which biases a valve poppet 210 against a valve seat to 12. During the power stroke of piston 94, water or liquid contained within passage 180 is increased to raise valve poppet 210 off valve seat 212 to allow outlet water or liquid to flow through valve assembly 158 into outlet 182. During the intake stroke of piston 194, outlet valve assembly 158 acts as a check valve and prevents high-pressure water in outlet passage 182 from flowing back through the assembly 158 and into passage or channel 180. In some embodiments, valve assembly 158 may additionally include a relief valve for removing excess pressure. In other embodiments, piston assembly 154 may have other configurations and may operate in other fashions.

Stand 134 supports engine 130 and pump 132. In one embodiment, stand 134 elevates engine 130 and pump 132 above a support surface, such as a floor or ground. FIGS. 6 and 7 illustrate stand 134 and portions of housing 150 separate from a remainder of pump 132. Stand 134 includes base 268, legs 270 and feet 272.

Base 268 comprises a platform or other structure configured to be joined or connected to underside of engine 130. Based 268 further interconnects each of legs 270. As a result, base 268 and legs 270 provide a single unitary structure to which engine 130 is connected. In the example illustrated, base 268 comprises an annular member or ring encircling housing 150. In other embodiments, base 268 may have other configurations. In yet other embodiments, base 268 may be omitted. In embodiments where base 268 is omitted, legs 270 may be connected independent of one another to cam enclosure 162 of housing 150 or other portions of housing 150.

Legs 270 extend from housing 250 of pump 132 and terminate at feet 272. Legs 270 are directly connected to housing 150 of pump 132. In the example illustrated, legs 270 are

directly connected to outer surface **176** of wall **171** of cam enclosure **162**. In the example illustrated, each leg **270** has a vertical portion **276** extending between the feet **272** and base **268** and a strut portion **278** extending from vertical portion **276** into direct contact and connection with housing **150**. In such an embodiment, housing **150** serves as a hub, wherein strut portions **278** serve as spokes forming a rigid unified structure. In yet other embodiments, strut portions **278** may alternatively extend between base **268** and housing **150** independent of legs **270**, which would omit strut portions **278**. Because legs **270** are located at equi-angularly spaced locations about housing **150**, stabilization of pump **132** and pressure washer **124** is enhanced.

In the example illustrated, strut portions **278** are directly connected to cam enclosure **162** of housing **150** at locations substantially horizontally opposite to wobble plate **190**, thrust washer **192** and the upper ends **198** of pistons **194**. As a result, strut portions **278** are connected to housing **150** proximate a vertical center portion of pump **132** and proximate to portions of pump **132** where larger forces are transmitted. As a result, stand **134** may better stabilize pump **132** and a better absorb and suppress vibration.

Because housing **150** of pump **132** is connected directly to stand **134**, stand **134** better stabilizes pump against vibration. Because housing **150** of pump **312** is connected directly to stand **134**, housing **150** of pump **132** supplements the rigidity of stand **134**. As a result, the combination of housing **150** and stand **134** forms a more rigid and sturdy structure for supporting pump **132** and engine **130**. In addition, because housing **150** of pump **130** forms a part of the overall structure supporting pressure washer **124**, pressure washer **124** may be formed with fewer parts, is less complex and is more compact.

In the particular example illustrated, legs **270** are directly connected to housing **150** of pump **132** at multiple spaced locations about pump **132**. Legs **270** are equi-angularly spaced about pump **132**. Housing **150** of pump **132** extends along and is centered about a vertical axis **175**, wherein legs **270** include at least three legs, and nominally four legs, angularly spaced from one another about axis **175**. In the embodiment illustrated, legs **270** concentrically extend about pump housing **150**. Housing **150** has a lower end **277** between locations where each of legs **270** is connected to housing **150** and feet **272**. As a result, pump **132** and its housing **150** are at least partially nested within and between legs **270**. Consequently, the height of pressure washer **124** is reduced, providing pressure washer **124** with a lower center of mass. The length of legs **270** may also be reduced. Thus, pressure washer **124** is more compact and more stable.

As shown by FIGS. **6** and **7**, stand **134** and its legs **270** are directly joined to outer surface **176** of pump housing **150** by being integrally formed as part of a single unitary body with surface **176** of housing **150**. As a result, the overall supporting structure provided by pump housing **150** and stand **134** is stronger and more rigid. Moreover, legs **270** and housing **150** are formed as a single unit, reducing cost and complexity. In one embodiment, pump housing **150** and legs **270** are integrally formed as a single unitary body from a cast, or molded metal, such as aluminum. In another embodiment, legs **270** are integrally formed as part of a single unitary body with wall **171** or surface **176** of housing **150** by being welded to wall **171**.

In yet other embodiments, stand **134** and its legs **270** are directly joined to outer wall **171** of pump housing **150** by being mounted directly to housing **150** or wall **171** of housing **150**. For example, in one embodiment, legs **270** may be riveted or otherwise fastened to housing **150** in a substantially permanent manner, wherein removal or separation of stand **134** from pump housing **150** would require breaking, cutting or severing of those elements securing stand **134** to pump housing **150**.

In still other embodiments, legs **270** may be directly connected to housing **150** of pump **132** in a removable fashion. For example, in one embodiment, legs **270** may be directly connected to pump housing **150** with screws, bolts or other fasteners which require the use of tools, but which allow legs **270** to be separated from pump housing **150** without permanent deformation or destruction of the fastening elements. In still other embodiments, legs **270** are directly connected to pump housing **50** with one or more releasable or removable fastening structures that allow legs **170** to be manually separated from pump housing **150** without the use of tools. For example, in one embodiment, each of legs **270** or multiples of legs **270** interconnected as a group or subgroup of the total number of legs **270** may be secured to pump housing **150** using tongue and groove arrangements, snap lock arrangements and the like. In one embodiment, housing **150** may be provided with the groove that is configured receive a tongue associated with one or more of legs **270**. In those embodiments in which legs **270** are removable or separable from housing **150** without deforming or destroying parts of the connection, legs **270** may be removed for storage or shipment. Legs **270** may also be removed for replacement or repair.

Feet **272** extend from a lower end of each of legs **270** and are configured to bear against or rest upon the supporting surface. Feet **272** provide a stable structure for supporting pressure washer **124**. In one embodiment, feet **272** may be provided with shoes **273** (showing FIG. **8**) which provide increased gripping or friction. In other embodiments, feet **272**, themselves, may have surfaces configured to grip a supporting surface. In the particular embodiment illustrated, two of feet **272** provide structures upon which wheel assemblies are mounted. In yet other embodiments, feet **272** may be omitted.

As shown by FIGS. **2** and **3**, handle **138** comprises a structure coupled to the remainder of pressure washer **124** configured to facilitate repositioning and transport of pressure washer **124**. Handle **138** includes a manual gripping portion **290** by which a person may manually grasp handle **238**. Gripping portion **290** extends above engine **130**. As a result, a person may individually move pressure washer **124** by grasping grouping portion **290** without having to bend over as much. In particular embodiments, handle **138** is configured to be actuated between different configurations or lengths such that gripping portion **290** may be set at different heights with respect to engine **124**. As a result, gripping portion **290** may be set at different heights to accommodate different heights of different individuals or gripping portion **290** may be repositioned below a top of engine **130** to facilitate compact storage or shipment.

In the particular embodiment illustrated, handle **138** is telescopic, wherein an upper portion **292** of handle **138** telescopically extends and retracts with respect to a lower portion **294** of handle **138**. In the example illustrated, lower portion **294** of handle **138** is bolted or otherwise fastened to feet **272** of two of legs **270**. As a result, feet **272** and legs **270** provide a secure, stable and convenient surface to which handle **138** may be secured. In other embodiments, handle **138** may be secured to other portions of stand **134**. In some other embodiments, handle **138** may alternatively be mounted to portions of the housing of engine **130**. In other embodiments, handle **138** may include multiple segments configured to be pivoted

or folded relative to one another. In yet other embodiments, handle **318** may have a single non-adjustable height or length.

Wheel assembly **140** comprises one or more wheels **296** rotationally coupled to pressure washer **124** to facilitate rolling movement of pressure washer **124**. In the example illustrated, wheel assembly **140** included two wheels **296** rotationally coupled to a lower end of lower portion **294** of handle **138** so as to elevate rear legs **270** (those legs **270** closest to wheels **296**) above the supporting surface or ground. Wheels **296** enable handle **138** to be tilted back to lift front legs **270** of stand **134**, allowing pressure washer **124** to be rolled when being moved. In other embodiments, wheel assembly **140** may be mounted to other structures, such as other portions of stand **134**. In some embodiments, wheel assembly **140** may be omitted.

FIG. **8** illustrates pressure washer **324**, another embodiment of pressure washer **24**. Pressure washer **324** is similar to pressure washer **124** except that pressure washer **324** includes handles **338** and **339** in place of handle **138** and includes wheel assembly **340** in place of wheel assembly **140**. Those remaining elements of washer **324** which correspond to elements of washer **124** are numbered similarly. As shown by FIG. **8**, in lieu of being mounted or connected directly to feet **272** of stand **134**, handle **338** and **339** are mounted directly to a housing or chassis of engine **130**. Handles **338** and **339** are located on a rear end and a front-end of pressure washer **324**. As a result, pressure washer **324** may be more easily transported or moved from either end.

Wheel assembly **340** is similar to wheel assembly **140** except that wheel assembly **340** has wheels **396** rotationally coupled to columns, pillars or posts **398** mounted to feet **272**. In the example illustrated, posts **398** are bolted to feet **272** through apertures in feet **272**. Posts **398** extend from two rear feet **272** and are rotationally journal axle **399** to which both the wheels **396** are attached. Axle **399** stabilizes the connection of wheel **396** to the remainder of pressure washer **324**. In other embodiments, wheels **396** may be rotationally coupled to legs **270** or other portions of stand **134** in other fashions.

Overall, pressure washers **24**, **124** and **324** have arrangements of an engine, a pump and a stand which is less complex, less costly and less space consuming. Because housing **50**, **150** of pump **32**, **132** is connected directly to stand **34**:**34**, pump **32**:**32** is better stabilized against vibration. Because housing **50**, **150** of pump **32**, **132** is connected directly to stand **34**, **134**, housing **50**, **150** of pump **32**, **132** supplements the rigidity of stand **34**, **134**. As a result, the combination of housing **50**, **150** and stand **34**, **134** forms a more rigid and sturdy structure for supporting pump **32**, **132** and engine **30**, **130**. In addition, because housing **50**, **150** of pump **32**, **132** forms a part of the overall structure supporting pressure washer **24**, **124**, pressure washer **24**, **124** may be formed with fewer parts, is less complex and is more compact.

What is claimed is:

1. An apparatus comprising:

an engine;

a pressure washer pump coupled to and driven by the engine, the pump having a housing; and

a stand directly connected to the pump housing, the stand comprising:

a horizontal platform connected to an underside of the engine; and

legs comprising:

vertical portions directly connected to and obliquely extending from the platform; and

strut portions obliquely extending from the housing to the vertical portions on an underside of the platform, wherein the housing includes an outer wall, the outer wall having an inner surface forming an internal chamber configured to contain a pressure washer wobble plate in a bath of lubricant and an outer surface opposite the inner surface and from which one of the struts portions extends.

2. The apparatus of claim **1** further comprising a handle coupled to the stand.

3. The apparatus of claim **2**, wherein the handle is removably coupled to the stand.

4. The apparatus of claim **2**, wherein the handle is above the engine.

5. The apparatus of claim **1**, wherein the engine is directly over the pump.

6. The apparatus of claim **1**, wherein the stand concentrically extends about the housing.

7. The apparatus of claim **1**, wherein

the legs terminate at feet.

8. The apparatus of claim **7**, wherein the housing has an upper end substantially at or below the horizontal platform and a lower end between the horizontal platform and the feet.

9. The apparatus of claim **7**, wherein the legs and the horizontal platform are integrally formed as a single unitary body.

10. The apparatus of claim **9**, wherein the legs are integrally formed as a single unitary body with the outer wall of the housing.

11. The apparatus of claim **1**, wherein the stand is removably connected to the housing.

12. The apparatus of claim **1**, wherein the stand is integrally formed as a single unitary body with the housing.

13. The apparatus of claim **1**, wherein the stand includes at least three legs, each leg being independently removable from the housing.

14. The apparatus of claim **1**, wherein the legs are integrally formed as a single unitary body with the outer wall of the housing.

15. The apparatus of claim **1**, wherein the pump housing extends along and is centered about a vertical axis and wherein the stand includes at least three legs angularly spaced from one another about the axis.

16. An apparatus comprising:

a pressure washer pump housing having an outer wall, the outer wall having an inner surface forming an internal chamber configured to contain a pressure washer wobble plate in a bath of lubricant and an outer surface opposite the inner surface; and

a stand directly connected to the outer surface of the outer wall of the pump housing, the stand comprising:

a horizontal platform connected to an underside of an engine; and

legs comprising:

vertical portions directly connected to and obliquely extending from the platform; and

strut portions obliquely extending from the housing to the legs on an underside of the platform, wherein the portions extend from the outer surface of the outer wall of the pressure washer pump housing.

17. A method comprising:

supporting an engine with a stand; and

supporting a pressure washer pump with the stand, wherein the stand is directly connected to a housing of the pressure washer pump, the stand comprising:

a horizontal platform connected to an underside of the engine; and

legs comprising:

vertical portions directly connected to and obliquely extending from the platform; and

strut portions obliquely extending from the housing to the vertical portions on an underside of the platform, wherein the housing includes an outer wall, the outer wall having an inner surface forming an internal chamber configured to contain a pressure washer wobble plate in a bath of lubricant and an outer surface opposite the inner surface and from which one of the portions extends.

18. The apparatus of claim **1**, wherein the strut portions each comprise one or more plates in a vertical orientation.

19. The apparatus of claim **1**, wherein the outer wall and said one of the strut portions are integrally formed as a single unitary body.

20. The apparatus of claim **1** further comprising:

feet extending outwardly from the legs;

posts extending from the feet; and

wheels rotatably supported by the feet.

21. An apparatus comprising:

an engine;

a pressure washer pump coupled to and driven by the engine, the pump having a housing; and

a stand directly connected to the pump housing, the stand comprising:

a horizontal platform connected to an underside of the engine; and

legs comprising:

vertical portions directly connected to and obliquely extending from the platform; and

strut portions obliquely extending from the housing to the vertical portions on an underside of the platform, wherein the housing includes an outer wall, the outer wall having an inner surface forming a liquid chamber through which liquid being pumped flows and an outer surface to which the stand is directly connected, wherein the legs are integrally formed as a single unitary body with the outer wall of the housing.

22. An apparatus comprising:

an engine;

a pressure washer pump coupled to and driven by the engine, the pump having a housing; and

a stand directly connected to the pump housing, the stand comprising:

a horizontal platform connected to an underside of the engine; and

legs integrally formed as a single unitary body with the horizontal platform and comprising:

vertical portions directly connected to and obliquely extending from the platform, the vertical portions terminating at feet; and

strut portions obliquely extending from the housing to the vertical portions of the legs on an underside of the platform, wherein the housing includes an outer wall, the outer wall having an inner surface forming an internal chamber configured to contain a pressure washer wobble plate in a bath of lubricant and an outer surface to which the stand is directly connected and wherein the strut portions are integrally formed as a single unitary body with the outer wall of the housing.

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